WHAT IS CLAIMED IS:

1. A hybrid valve apparatus for use with an aspiration actuator and a dispensing actuator to transfer fluid from a reservoir to a test site on a substrate surface comprising:

a valve assembly movable between an aspiration condition and a dispensing condition; and

a manifold device providing a fluid aspiration conduit having a first aspiration port in fluid communication with the aspiration actuator, and a second aspiration port in selective fluid communication with the valve assembly to selectively aspirate a liquid sample slug from the reservoir into a discrete sample path when the valve assembly is in the aspiration condition, said manifold device further providing a fluid dispensing conduit having a first dispensing port in fluid communication with the dispensing actuator, and a second dispensing port in selective fluid communication with the valve assembly to selectively dispense at least one droplet of the liquid sample slug from the sample path when the valve assembly is in the dispensing condition,

wherein, in the aspiration condition, said sample path is out of fluid communication with the dispensing actuator and, in the dispensing condition, said sample path is out of fluid communication with the aspiration actuator.

2. The hybrid valve apparatus as defined by claim 1, wherein

said manifold includes a primary passage defining at least a portion of the sample path.

3. The hybrid valve apparatus as defined by claim 2, further including:

a nozzle member having one end fluidly coupled to said primary passage and an opposite end terminating at a dispensing orifice configured to dispense said droplet.

4. The hybrid valve apparatus as defined by claim 3, wherein

said primary passage is of a transverse cross-sectional area from about 0.2 mm^2 to about 0.8 mm^2.

5. The hybrid valve apparatus as defined by claim 1, wherein

said manifold device includes a stator face containing the second aspiration port and the second dispensing port, and said valve assembly includes a valve body having a contact face slideably contacting the stator face at a stator-contact interface for sliding sealed contact between

the aspiration condition, fluidly coupling the second aspiration port to the sample path, and

the dispensing condition, fluidly coupling the second dispensing port to the sample path.

6. The hybrid valve apparatus as defined by claim 5, wherein

said contact face of the valve body includes

an aspiration channel, fluidly coupling the second aspiration port to the sample path through the aspiration channel, in the aspiration condition, and

a dispensing channel, fluidly coupling the second dispensing port to the sample path through the dispensing channel, in the dispensing condition.

7. The hybrid valve apparatus as defined by claim 6, wherein

said manifold device includes a primary passage defining at least a portion of the sample path, and having an upper communication port terminating at the stator face for fluid communication with the aspiration channel in the aspiration condition, and for fluid communication with the dispensing channel in the dispensing condition.

8. The hybrid valve apparatus as defined by claim 7, further including:

a nozzle member having one end fluidly coupled to said primary passage and an opposite end terminating at a dispensing orifice configured to dispense said droplet.

9. The hybrid valve apparatus as defined by claim 6, wherein

at least one of said valve body and said manifold device is rotatable about a rotation axis extending substantially perpendicular to the stator-contact interface to rotate said contact face, said aspiration channel and said dispensing channel relative to the stator face between the aspiration condition and the dispensing condition.

10. The fluid transfer apparatus as defined by claim 9, wherein

said dispensing channel and said aspiration channel extend in a direction substantially radially about said rotational axis.

11. The fluid transfer apparatus as defined by claim 5, wherein

said manifold device includes

a primary passage having an upper communication port terminating at the stator face, and an opposite end in fluid communication with a nozzle member having a dispensing orifice configured to dispense said droplet, and

a source conduit having an upper communication opening terminating at the stator face, and an opposite end in fluid communication with the reservoir.

12. The fluid transfer apparatus as defined by claim 11, wherein

said contact face of the valve body includes a sample channel forming at

least a portion of the sample path, said sample channel fluidly coupling the second aspiration port of the aspiration conduit to the upper communication opening of the source conduit, in the aspiration condition, and fluidly coupling the second dispensing port of the dispensing conduit to the upper communication port of the primary passage, in the dispensing condition.

13. The fluid transfer apparatus as defined by claim 12, wherein

said manifold device includes a flush passage having an upper flush port terminating at the stator face, and an opposite end in fluid communication with a flush source, and

said contact face of the valve body includes a flush channel fluidly coupling the flush port of the flush passage to the upper communication port of the primary passage, in the aspiration condition, to flush said nozzle member, and fluidly coupling the flush port to the upper communication opening of the source conduit, in the dispensing condition.

14. The fluid transfer apparatus as defined by claim 1, further including:

a digitally regulated hydraulic pressure system in fluid communication with the dispensing actuator for precision operation thereof.

15. A manifold device for use with a valve assembly, an aspiration source and a dispensing source to transfer fluid from at least one of a plurality of fluid reservoirs to at least one test site on a substrate surface, said valve assembly including a rotor face defining a plurality of discrete communication channels each movable as a unit between an aspiration condition and a dispensing condition as the valve assembly rotates relative its rotational axis, said manifold device comprising:

a manifold body defining a plurality of fluid aspiration conduits each having a first aspiration port in fluid communication with the aspiration source,

and a second aspiration port in selective fluid communication with a corresponding communication channel of the valve assembly to aspirate a respective liquid sample slug from a corresponding reservoir of sample fluid into discrete sample paths when the valve assembly is in the aspiration condition, said manifold body further defining a plurality of fluid dispensing conduits each having a respective first dispensing port in fluid communication with the dispensing source, and a second dispensing port in selective fluid communication with a corresponding communication channel of the valve assembly to selectively dispense at least one droplet of the corresponding liquid sample slug from the corresponding sample path when the valve assembly is in the dispensing condition,

wherein, in the aspiration condition, said respective sample paths are out of fluid communication with the dispensing source and, in the dispensing condition, said respective sample paths are out of fluid communication with the aspiration source.

16. The manifold device as defined by claim 15, wherein

said manifold body includes a stator face containing the second aspiration ports and the second dispensing ports, and formed for rotational sliding contact with the rotor face at a rotor-stator interface for sliding sealed contact between

the aspiration condition, fluidly coupling the corresponding second aspiration port to the corresponding sample path, and

the dispensing condition, fluidly coupling the corresponding second dispensing port to the corresponding sample path.

17. The manifold device as defined by claim 16, wherein

said stator face is substantially planar.

18. The manifold device as defined by claim 16, wherein

said manifold body includes a plurality of primary passages each having an upper communication port terminating at the stator face such that said respective communication channel fluidly couples the corresponding primary passage to the aspiration source in the aspiration condition, and fluidly couples the respective primary passage to the dispensing source in the dispensing condition.

19. The manifold device as defined by claim 18, further including:

a plurality of removable nozzle members mounted to said manifold body, and each having one end fluidly coupled to a corresponding primary passage and an opposite end terminating at a dispensing orifice configured to dispense a respective droplet.

20. The manifold device as defined by claim 15,wherein

said manifold body includes at least two plate members fixedly mounted together in a manner cooperatively defining at least one of said aspiration conduits and said dispensing conduits.

21. The manifold device as defined by claim 20,wherein

said at least two plate members includes a first plate member having a bottomside surface and a second plate member having an opposed topside surface fixedly joined therebetween at a first interface, at least one of said bottomside surface and said topside surface defining a plurality of first grooves which cooperate with the other of the topside surface of the second plate member and the bottomside surface of the first plate member to define at least one of the aspiration conduits or the dispensing conduits.

22. The manifold device as defined by claim 21, wherein

each said second aspiration port and said second dispensing port terminates at a stator face of the first plate member which is oriented opposite the bottomside surface thereof, said stator face being configured for rotational sliding contact with the rotor face at a rotor-stator interface.

23. The manifold device as defined by claim 22, wherein

said manifold body includes a plurality of primary passages each having an upper communication port terminating at the stator face such that said respective sample channel fluidly couples the corresponding primary passage to the aspiration source in the aspiration condition, and fluidly couples the respective primary passage to the dispensing source in the dispensing condition.

24. The manifold device as defined by claim 21, wherein

said topside surface and said bottomside surface are substantially planar.

25. The manifold device as defined by claim 21, wherein,

said second plate member includes a bottomside surface positioned opposite said topside surface thereof, and further including:

a third plate member having a topside fixedly joined to the bottomside surface of the second plate member at a second interface, at least one of said bottomside surface of the second plate member and the topside surface of the third plate member defining a plurality of second grooves which cooperate with the other of the topside surface of the third plate member and the bottomside surface of the second plate member to define at least the other of the aspiration conduits or the dispensing conduits.

26. The manifold device as defined by claim 25, wherein

each said second aspiration port and said second dispensing port terminates at a stator face of the first plate member which is oriented opposite

the first interface surface, said stator face being configured for rotational sliding contact with the rotor face at a rotor-stator interface.

27. A fluid transfer apparatus for transferring fluid from a reservoir to a test site on a substrate surface comprising:

an aspiration source;

a dispensing source;

a manifold device providing a fluid aspiration conduit having a first aspiration port in fluid communication with the aspiration source, and a second aspiration port terminating at a stator face, said manifold device further providing a fluid dispensing conduit having a first dispensing port in fluid communication with the dispensing source, and a second dispensing port terminating at the stator face; and

a valve assembly cooperating with the stator face between:

an aspiration condition, fluidly coupling the second aspiration port to a discrete sample path to selectively aspirate a liquid sample slug from the reservoir into the sample path, while fluidly decoupling the second dispensing port from the sample path to prevent fluid communication with the dispensing source, and

a dispensing condition, fluidly coupling the dispensing port to the sample path to selectively dispense at least one droplet of the liquid sample slug therefrom, while fluidly decoupling the second aspiration port from the sample path to prevent fluid communication with the aspiration source.

28. The fluid transfer apparatus as defined by claim 27, wherein

said manifold includes a primary passage defining at least a portion of the sample path and having a upper communication port terminating at the stator face.

29. The fluid transfer apparatus as defined by claim 28, further including:

a nozzle member having one end fluidly coupled to said primary passage and an opposite end terminating at a dispensing orifice configured to dispense said droplet.

30. The fluid transfer apparatus as defined by claim 27, wherein

said valve assembly includes a valve body having a contact face slideably contacting the stator face at a stator-contact interface for sliding sealed contact between

the aspiration condition, fluidly coupling the second aspiration port to the sample path, and

the dispensing condition, fluidly coupling the second dispensing port to the sample path.

31. The fluid transfer apparatus as defined by claim 30, wherein

said contact face of the valve body includes

an aspiration channel, fluidly coupling the second aspiration port to the sample path through the aspiration channel, in the aspiration condition, and

a dispensing channel, fluidly coupling the second dispensing port to the sample path through the dispensing channel, in the dispensing condition.

32. The fluid transfer apparatus as defined by claim 31, wherein

said manifold device includes a primary passage defining at least a portion of the sample path, and having an upper communication port terminating at the stator face.

33. The fluid transfer apparatus as defined by claim 32, wherein

said valve body is rotatably mounted about a rotation axis extending

substantially perpendicular to the stator-contact interface to rotate said contact face, said aspiration channel and said dispensing channel relative to the stator face between the aspiration condition and the dispensing condition.

34. The fluid transfer apparatus as defined by claim 33, wherein

said dispensing channel and said aspiration channel extend in a direction substantially radially about said rotational axis.

35. The fluid transfer apparatus as defined by claim 30, wherein

said manifold device includes

a primary passage having an upper communication port terminating at the stator face, and an opposite end in fluid communication with a nozzle member having a dispensing orifice configured to dispense said droplet, and

a source conduit having an upper communication opening terminating at the stator face, and an opposite end in fluid communication with the reservoir.

36. The fluid transfer apparatus as defined by claim 35, wherein

said contact face of the valve body includes a sample channel forming at least a portion of the sample path, said sample channel fluidly coupling the second aspiration port of the aspiration conduit to the upper communication opening of the source conduit, in the aspiration condition, and fluidly coupling the second dispensing port of the dispensing conduit to the upper communication port of the primary passage, in the dispensing condition.

37. The fluid transfer apparatus as defined by claim 36, wherein

said manifold device includes a flush passage having an upper flush port terminating at the stator face, and an opposite end in fluid communication with

a flush source, and

said contact face of the valve body includes a flush channel fluidly coupling the flush port of the flush passage to the upper communication port of the primary passage, in the aspiration condition, to flush said nozzle member, and fluidly coupling the flush port to the upper communication opening of the source conduit, in the dispensing condition.

38. The fluid transfer apparatus as defined by claim 30,wherein

said manifold device includes at least two plate members fixedly mounted together in a manner cooperatively defining at least one of the aspiration conduit and said dispensing conduit.

39. The fluid transfer apparatus as defined by claim 38,wherein

said at least two plate members includes a first plate member having a first interface surface and a second plate member having an opposed second interface surface fixedly joined therebetween at a first interface, said first interface surface defining a first groove which cooperates with the second interface surface of the second plate member to define at least one of the aspiration conduit and the dispensing conduit.

40. The fluid transfer apparatus as defined by claim 39, wherein

said stator face of the first plate member is oriented opposite the first interface surface, and said stator face is configured for rotational sliding contact with the contact face at a contact-stator interface.

41. The fluid transfer apparatus as defined by claim 40, wherein

said stator face and said contact face are substantially planar.

42. The fluid transfer apparatus as defined by claim 27 wherein

said dispensing source includes drop-on demand ink-jet printing valving.

43. The fluid transfer apparatus as defined in 42, further including

a digitally regulated hydraulic pressure system which supplies a computer-selectable fluid pressure head to the ink-jet printing valving to effectively alter the dispensing range.

44. The fluid transfer apparatus as defined in 42, wherein

said ink-jet printing valving is adapted to articulate the voltages that are pulse width-independent to enable improved dispensing precision.

45. The fluid transfer apparatus as defined by claim 42 wherein

said ink-jet printing valving is one of a thermal ink-jet valve, a solenoid ink-jet valve, a piezoelectric ink-jet valve, and a pneumatic pilot valve.

46. The fluid transfer apparatus as defined by claim 27 wherein

said aspiration source includes a syringe-type metering device.

47. The fluid transfer apparatus as defined by claim 46 wherein

said syringe-type metering device includes a multiple selector valve connecting a single syringe-type metering device to multiple fluid paths.

48. The fluid transfer apparatus as defined by 27 wherein

said aspiration source includes a diaphragm pump-type metering device.

49. The fluid transfer apparatus as defined by 27 wherein

said aspiration source includes a peristaltic pump-type metering device.

50. The fluid transfer apparatus as defined by claim 27, wherein

said aspiration source includes a plurality of aspiration actuators, and

said dispensing source includes a plurality of dispensing actuators to transfer fluid from a plurality of fluid reservoirs to a plurality of test sites on a substrate surface, and

said manifold device including a plurality of fluid aspiration conduits each having a first aspiration port in fluid communication with a corresponding aspiration actuator, and a second aspiration port terminating at the stator face for selective fluid communication with the valve assembly to selectively aspirate a respective liquid sample slug from a corresponding reservoir of sample fluid into discrete sample paths when the valve assembly is in the aspiration condition, said manifold body further defining a plurality of fluid dispensing conduits each having a respective first dispensing port in fluid communication with a corresponding dispensing actuator, and a second dispensing port terminating at the stator face for selective fluid communication with the valve assembly to selectively dispense at least one droplet of the corresponding liquid sample slug from the corresponding sample path when the valve assembly is in the dispensing condition wherein, in the aspiration condition, each respective sample path is out of fluid communication with the respective dispensing actuator and, in the dispensing condition, each respective sample path is out of fluid communication with the respective aspiration actuator.

51. The fluid transfer apparatus as defined by claim 50, wherein

said valve assembly includes a valve body having a contact face slideably contacting the stator face at a stator-contact interface for sliding sealed contact between

the aspiration condition, fluidly coupling each of the second aspiration ports to the corresponding sample path, and

the dispensing condition, fluidly coupling each of the second dispensing ports to the corresponding sample path.

52. The fluid transfer apparatus as defined by claim 51, wherein

said contact face of the valve body includes

a plurality of aspiration channels, each fluidly coupling the corresponding second aspiration port to the corresponding sample path through the corresponding aspiration channel, in the aspiration condition, and

a plurality of dispensing channels, each fluidly coupling the corresponding second dispensing port to the corresponding sample path through the corresponding dispensing channel, in the dispensing condition.

53. The fluid transfer apparatus as defined by claim 52, wherein

said manifold device includes a plurality of primary passages each defining at least a portion of a respective sample path, each having a upper communication port terminating at the stator face such that a respective aspiration channel fluidly couples a respective primary passage to a respective aspiration actuator, in the aspiration condition, and a respective dispensing channel fluidly couples a respective primary passage to a respective dispensing actuator in the dispensing condition.

54. The fluid transfer apparatus as defined by claim 53, wherein

said manifold device includes a first plate member having a first interface surface and a second plate member having an opposed second interface surface fixedly joined therebetween at a first interface, said first interface surface defining a plurality of first grooves each of which cooperates with the second interface surface of the second plate member to define at least one of the plurality of aspiration conduits and the dispensing conduits.

55. The fluid transfer apparatus as defined by claim 53, wherein said manifold is comprised of one of glass, synthetics or stainless steel.

56. The fluid transfer apparatus as defined by claim 51, wherein said manifold device includes

a plurality of primary passages each having an upper communication port terminating at the stator face, and an opposite end in fluid communication with a respective nozzle member having a dispensing orifice configured to dispense said droplet, and

a plurality of source conduits each having an upper communication opening terminating at the stator face, and an opposite end in fluid communication with the reservoir.

57. The fluid transfer apparatus as defined by claim 56, wherein said contact face of the valve body includes a plurality of sample channels each forming at least a portion of the corresponding sample path, each said sample channel fluidly coupling the corresponding second aspiration port of the aspiration conduit to the corresponding upper communication opening of the source conduit, in the aspiration condition, and fluidly coupling the corresponding second dispensing port of the dispensing conduit to the corresponding upper communication port of the primary passage, in the dispensing condition.

58. The fluid transfer apparatus as defined by claim 57, wherein said manifold device includes a flush passage having an upper flush port terminating at the stator face, and an opposite end in fluid communication with a flush source, and

said contact face of the valve body includes a flush channel fluidly coupling the flush port of the flush passage to the respective upper

communication ports of the primary passages, in the aspiration condition, to flush said nozzle members, and fluidly coupling the flush port to the respective upper communication openings of the source conduits, in the dispensing condition.

59. A method of transferring liquid sample from a fluid reservoir to a test site on a target substrate comprising:

providing a fluid manifold device defining a fluid aspiration conduit having a first aspiration port in fluid communication with an aspiration actuator and a second aspiration port in fluid communication with the valve assembly, said manifold device further defining a fluid dispensing conduit having a first dispensing port in fluid communication with the dispensing actuator and a second dispensing port in fluid communication with the valve assembly;

positioning the valve assembly in an aspiration condition, fluidly coupling the aspiration actuator to a discrete sample path, and fluidly decoupling the dispensing actuator from the sample path;

actuating the aspiration actuator to aspirate a liquid sample slug from a sample reservoir into the sample path; and

positioning the valve assembly in a dispensing condition, fluidly coupling the dispensing actuator to the sample path, and fluidly decoupling the aspiration actuator from the same path.

60. The method according to claim 59, wherein

said manifold device includes a primary passage having a upper communication port terminating a stator face of the manifold, said stator face further containing the second aspiration port and the second dispensing port.

61. The method according to claim 60, wherein

said positioning the valve assembly to the aspiration condition or the

dispensing condition includes slideably engaging a contact face of the valve assembly against the stator face of the manifold device at a stator-contact interface, to fluidly couple the aspiration actuator to the sample path or fluidly couple the dispensing actuator to the sample path, respectively.

62. The method according to claim 61, wherein

said slideably engaging includes rotating an aspiration channel and a dispensing channel in the contact face of the valve assembly about a rotation axis thereof, relative the stator face, to

fluidly couple the upper communication port with the second aspiration port, through the aspiration channel, in the aspiration condition, and

fluidly couple the upper communication port with the second dispensing port, through the dispensing channel, in the dispensing condition.